

# Abstract

A wireless communications simulator was developed in Python, enabling the configuration of a physical scenario composed of a base station, a set of reflectors and one or more mobile devices. The software performs the calculation of the corresponding wireless channel scenario and is capable of simulating several types of communication systems over it. It is equipped with modules that allow transmission using different modulation schemes and, also, make use of space-time codes. Additionally, different mobility models were developed, as well as modules that simulate the channel state information. The software architecture was conceived from an object oriented programming perspective, conferring flexibility in terms of development and addition of new modules and features. Also, parallel calculation techniques were implemented in graphic processors to improve the performance of the simulator in terms of computations time consumption. Results showing the performance improvement are also shown. On the other hand, different diversity schemes were tested and the improvements that they produce were verified through simulations. The evaluation of different channels and transmission systems were performed, paying special attention to systems with multiple antennas. The software allows one to obtain bit error probability and capacity results. Different notions of capacity are reviewed and an algorithm was implemented to calculate a so-called *practical capacity*. This allowed us to compare simulated with theoretical results in those wireless channels for which, given their characteristics, there exists a statistical model allowing to calculate such theoretical curves. In addition, simulations were carried out on channels whose characteristics differ from these models as well as on systems in which there is an imperfection in the channel state information. Finally, the software shows patterns of radiation and intensity, channel force maps, channel taps statistics and impulse responses. These results allow one to improve the understanding of systems and characteristics of wireless channels.

**Keywords:** WIRELESS COMMUNICATIONS, SIMULATOR, MIMO, GPU